METHOD AND APPARATUS FOR CHARACTERIZING HIGH-ENERGY ELECTROCHEMICAL CELLS USING POWER FUNCTIONS OBTAINED FROM CALORIMETRY

ABSTRACT OF THE DISCLOSURE

Characterizing electrochemical cell components and a response of an electrochemical cell to a specified operating condition involves preparing a sample of an electrode material in contact with an electrolyte. Self-heating, power-temperature or power-time data is obtained for the sample using a calorimetry technique, such as by use of an accelerating rate calorimetry technique or a differential scanning calorimetry technique. A power function is developed for the sample using the self-heating, power-temperature or power-time data. The power function is representative of thermal power per unit mass of the sample as a function of temperature and amount of reactant remaining from a reaction of the sample electrode material and electrolyte. A first power function is developed that characterizes a reaction between the cathode material and the electrolyte in terms of thermal power per unit mass of a cathode sample material, and a second power function is developed that characterizes a reaction between the anode material and the electrolyte in terms of thermal power per unit mass of the anode sample material. An electrode material sample from which a power function is developed is prepared using less than about 100 grams of the electrode material, such as between about 1 and 10 grams, but may be as little as between about 1 milligram and 1 gram. A computer system and computer-readable medium are provided to electronically design and test cells of arbitrary size and shape using power functions developed for individual electrode/electrolyte combinations.